Space Weather Technical Forecast

Issued on Friday, 12 April 2024 at 13:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1 Minor Geomagnetic Storms day 2-3 (13-14 Apr). Chance of M-flares.

Solar Activity: Moderate, with a peak flare of M5.4 at 11/1706 UTC from behind the east limb, likely a combined flare from returning regions AR3614 and AR3615. There are five sunspot regions on the Earth-facing Sun. AR3634 and AR3635 are the most complex, but remain relatively small and simple bipolar groups. The other groups are mature, simple and relatively stable unipolar regions.

A number of CMEs were observed from around the eastern limb, along with a filament eruption just southwest of centre disc. The resultant CME is very faint, and still under analysis with current imagery very limited. However preliminary assessment suggests a very faint halo CME with potential arrival later on Apr 14.

Solar Wind / Geomagnetic Activity: Solar wind speeds, as observed by DSCOVR at L1 eased from slightly elevated to near background, from 450-500km/s to around 400km/s. Density has been around or below average. Total Interplanetary Magnetic Field (IMF) strength, Bt, was weak throughout, under 6nT, with the north-south component also varying weakly between -5nT and +6nT. Phi angle was positive (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background. High energy electron flux (greater than 2MeV) observed at GOES16 was Background to Moderate. The associated 24-hour fluence remained below Active (1e8 integrated flux) with a value of 7.04e6 integrated pfu recorded at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected with a chance of M-flares, most likely from new regions rotating onto the west disc.

Solar Wind / Geomagnetic Activity: There are two potential Earth-directed CMEs. The first, from a filament eruption around 11/0540 UTC, gives the potential for a glancing impact later day 2 or early day 3 (13-14 Apr). The second from a filament eruption around 12/0030 UTC, is still under assessment but currently gives a chance of an arrival later on day 3 (14 Apr). Otherwise current slightly elevated winds will continue to gradually ease before the onset of any fast wind from CH24/-, most likely occurring later day 2 or day 3 (13-14 Apr). Geomagnetic activity is forecast to be mainly Quiet with Unsettled intervals day 1 and into day 2 (12-13 Apr). This likely increasing to Unsettled to Active with a chance of G1 Minor Storms later day 2 or day 3 (13-14 Apr), especially if any arrivals combine. Any activity easing back to mainly Quiet to Unsettled day 4 (15 Apr).

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES-18 is expected to persist at Background. High energy electron flux at GOES16 is expected to ease from Moderate to Background, to mainly Background, with the onset of any fast winds. Flux potentially rising to Moderate, perhaps High day 4 (15 Apr). The associated 24-hour electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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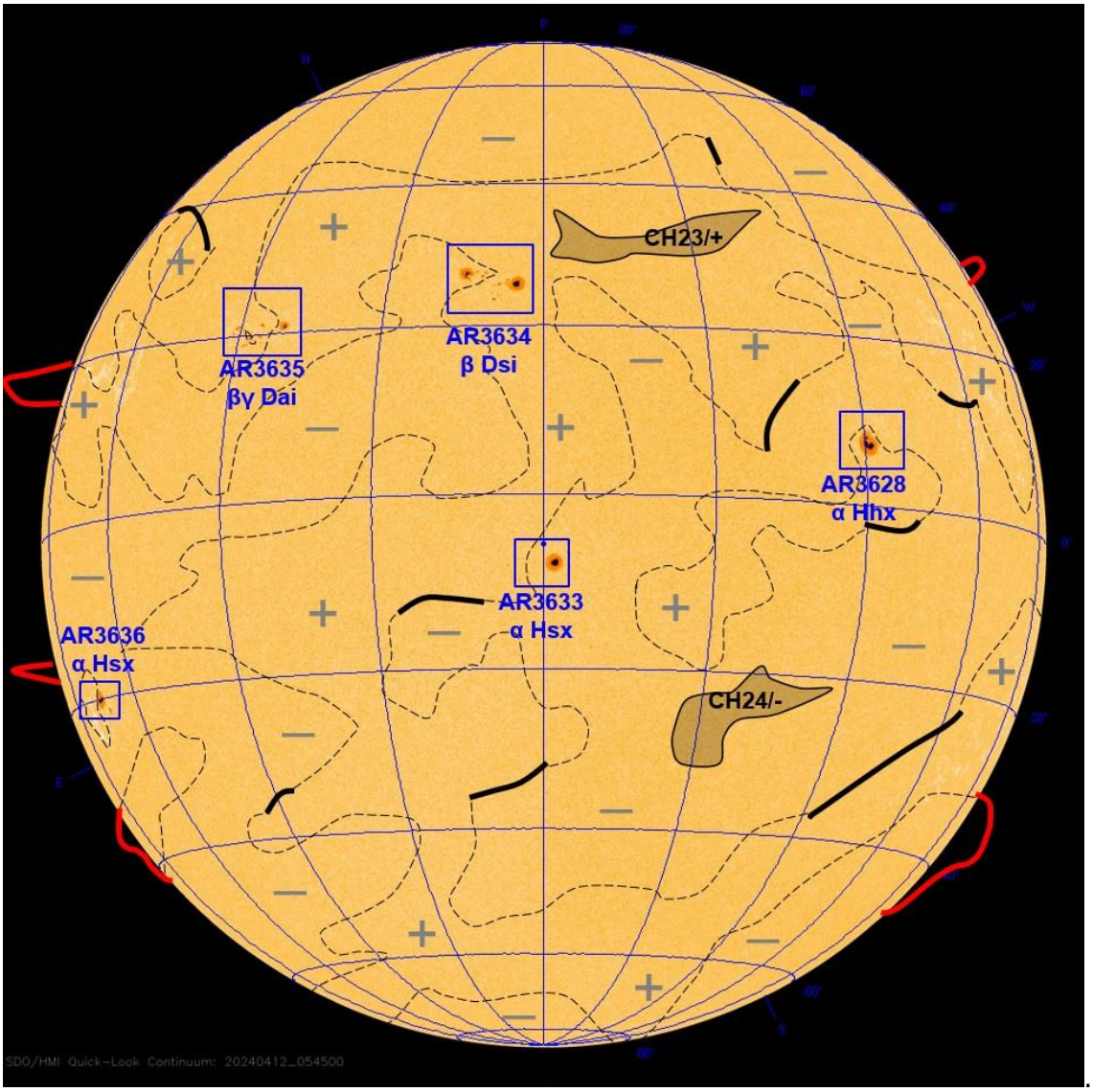
Figure 1. Solar Analysis Valid 12/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are two filament eruptions of note. The first is a revaluated CME from the north-centre filament eruption on 11 Apr. Despite its original location, this was seen as a faint partial halo to the southeast and has the potential to give a glancing impact overnight on day 2 (13-14 Apr). This CME is low confidence however, as further, likely far-sided CMEs, contaminate the analysis. A second filament eruption was observed just southwest of centre disc around 12/0030 UTC. The subsequent CME is very faint, but perceptible on SOHO C2 and STEREO A difference imagery, as a full halo. Any arrival is most likely during the second half of day 3 (14 April).

Current slightly elevated to backgrounds are also likely to become enhanced either later on day 2 or early day 3 (13-14 Apr) due to the arrival of the fast wind from CH24/-. This is a recurrent feature with 450km/s observed last rotation, while negative coronal holes are also still favoured for connection. However confidence is low due to the lack of notable enhancement observable in Enlil, besides the potential CME glance.

Geomagnetic activity is forecast to be mainly Quiet with Unsettled intervals day 1 and into day 2 (12-13 Apr). Onset of fast winds later day 2 or day 3, along with CME arrivals, will likely increase this to Unsettled to Active with a chance of G1 Minor Storms. Any activity easing back to mainly Quiet to Unsettled day 4 (15 Apr).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	20	30	20
Strong	G3	No	1	5	5	5
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
11/0856	Partial	Filament	N-centre (SE directed)	1150	13/1800 -6/+12hrs	Glancing impact. Low confidence. Analysis ongoing.
12/0542	Full	Filament	SW of centre	739	14/1600 -6 hr/+12hrs	Low confidence analysis ongoing.

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Radio Blackouts - X-Ray Flares:

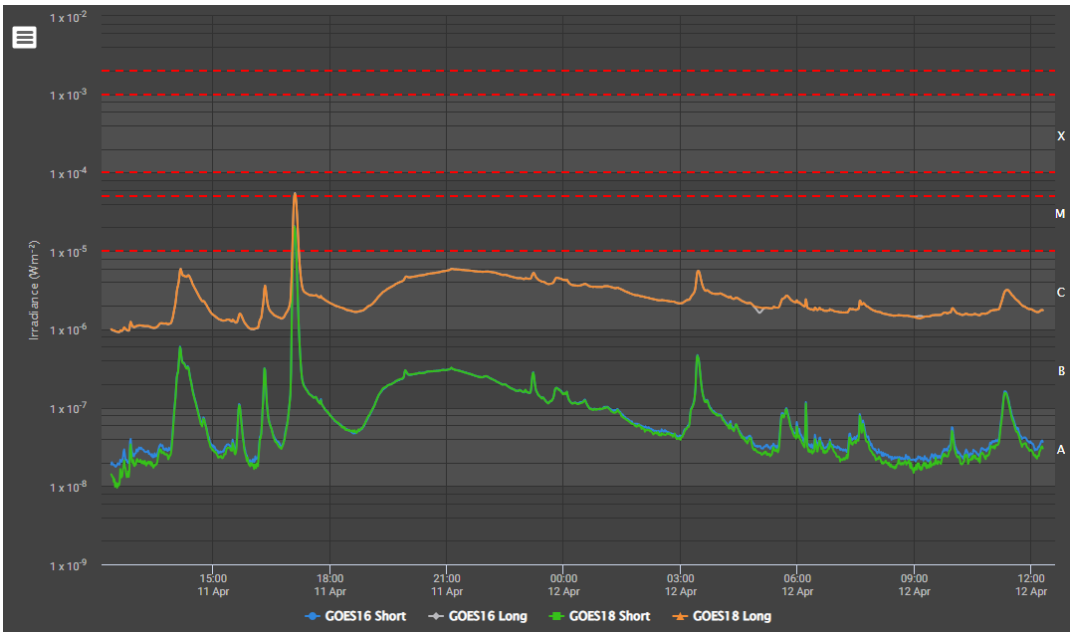
Low to Moderate activity is forecast, with the potential for further isolated M-flares, mainly due to regions likely rotating onto the disc.

The recent M5.4 flare, likely a combined flare from ex-AR3614 and ex-AR3615 from over the east limb, suggests that these regions have persisted across the far-side and remain active. This is supported by recent observed CME activity from the limb. This gives a chance of further M-flares as they rotate onto the disc, while an isolated X-class flare cannot be ruled out. However, this risk will be re-evaluated as these regions move into a more visible location.

Of the five regions on the disc, AR3634 in the north centre and AR36335 in the northeast are the main regions of note, although these remain relatively small and simple bipolar groups. Recent growth of these regions also appears to have largely stalled. The other three regions are currently stable, as simple and mature unipolar spots.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES 16/18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES18 is at background levels. Solar radiation storms are currently not expected given the lack of active sunspot regions either on or moving into in the western portion of the disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux observed by GOES-16 is Background to Moderate, and likely to decline to Background with the onset of any fast winds later day 2 or day 3, alongside any CME influence. Once solar wind pressure eases, count rates have the potential to return to Moderate, and potentially peaking High later day 4 (15 Apr).

The associated electron fluence remains below the Active level, and is expected to persist at this level, although with a rising trend likely day 4 onward (15 Apr). This is supported by REFM, which is currently giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	5
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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